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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* QIN LIU, CHARLES C. HALUZAK, MARZIO LEBAN,  
LAWRENCE R. PLOTKIN, AND KENNETH E. TRUEBA

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Appeal 2009-0640  
Application 10/061,830  
Technology Center 1700

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Decided:<sup>1</sup> March 30, 2009

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Before CHARLES F. WARREN, PETER F. KRATZ, and  
CATHERINE Q. TIMM, *Administrative Patent Judges*.

WARREN, *Administrative Patent Judge*.

DECISION ON APPEAL

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<sup>1</sup> The two month time period for filing an appeal or commencing a civil action specified in 37 C.F.R. § 1.304, begins to run from the “Decided” date shown on this page of the decision. The time period does not run from the Mail Date (paper delivery) or Notification Date (electronic delivery).

Applicants appeal to the Board from the decision of the Primary Examiner finally rejecting claims 1 through 9, 11 through 17, 20, and 82 through 89 in the Office Action mailed January 11, 2005. 35 U.S.C. §§ 6 and 134(a) (2002); 37 C.F.R. § 41.31(a) (2005).

We affirm-in-part the decision of the Primary Examiner.

Claims 1, 4, 8, 14, 16, 20, 82, 83, and 86 illustrate Appellants' invention of a fuel cell system, and are representative of the claims on appeal:

1. A fuel cell system, comprising:  
a fuel cell stack including a plurality of anodes; and  
a single fuel supply apparatus that supplies a plurality of fuel droplets to each of the electrodes.
4. A fuel cell system, comprising:  
a fuel cell stack including at least one anode; and  
a thermal drop ejector that supplies a plurality of fuel droplets to the at least one anode.
8. A fuel cell system, comprising:  
a fuel cell stack including at least one anode pair arranged such that the anodes within the anode pair face one another and define a fuel passage therebetween that extends from one anode in the pair to the other anode in the pair; and  
fuel supply means for supplying a plurality of droplets to the fuel passage between the at least one anode pair.
14. A method of operating a fuel cell stack comprising the steps of:  
directing a spray of fuel droplets into a fuel passage that extends from a first anode in an anode pair to a second anode in the anode pair such that at least some of the droplets come to rest on the first anode and at least some of the droplets come to rest on the second anode; and  
consuming the fuel at the anodes.

16. A method of operating a fuel cell having an anode, the method comprising the steps of:

directing a spray of fuel droplets onto the anode by generating a spray of fuel droplets and blowing the droplets towards the anode with a fan; and  
consuming the fuel at the anode.

20. A fuel supply system for use with a fuel cell including an anode, comprising:

a fuel reservoir that stores fuel;  
fuel supply means, operably connected to the fuel reservoir, for supplying a plurality of droplets to the at least one anode; and  
a controller adapted to monitor a rate of fuel consumption at the anode and to control the fuel supply means to supply droplets at a rate that results in a fuel layer being maintained on the anode.

82. A fuel cell system, comprising:

a fuel cell stack including at least one anode defining a surface that receives fuel and a fuel passage adjacent to the anode surface that receives fuel; and

a fuel supply apparatus that directs a plurality of fuel droplets into the fuel passage in a direction that is non-perpendicular to the anode surface that receives the fuel.

83. A fuel cell system as claimed in claim 82, wherein the fuel supply apparatus directs a plurality of droplets into the fuel passage in a direction that is substantially parallel to the anode surface that receives fuel.

86. A fuel cell system as claimed in claim 82, wherein the fuel supply apparatus comprises a thermal drop injector.

The Examiner relies upon the evidence in these references (Third Supp. Ans. 3):<sup>2</sup>

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<sup>2</sup> We consider these documents: Third Supplemental Examiner's Answer mailed October 9, 2007; Appeal Brief filed August 17, 2005; Reply Brief filed March 9, 2006; Supplemental Reply Brief filed February 1, 2007;

Pun	US 6,152,382	Nov. 28, 2000
Kindler	US 6,440,594 B1	Aug. 27, 2002
Singh	US 6,572,993 B1	Jun. 3, 2003

Appellants request review of the following grounds of objection and rejection advanced on appeal (App. Br. 7-10):

claim 83 is objected to under 35 U.S.C. § 132 as introducing new matter into the disclosure of the invention (Ans. 3);

claim 83 is rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement (Ans. 4).;

claims 1 through 3, 7, 8, 11 through 15, 17, 20, 82, 84, 85, and 89 are rejected under 35 U.S.C. § 102(e) as unpatentable over Kindler (Ans. 4);

claims 4 through 6 and 86 through 88 are rejected under 35 U.S.C. § 103(a) as unpatentable over Kindler (Ans. 9);

claim 9 is rejected under 35 U.S.C. § 103(a) as unpatentable over Kindler in view of Singh (Ans. 10); and

claim 16 is rejected under 35 U.S.C. § 103(a) as unpatentable over Kindler in view of Pun (Ans. 11).

Appellants argue the second ground of rejection based on claims 1 through 3 and 7; claims 8 and 11 through 13; claims 14, 15, and 17; claim 20; and claims 82, 84, 85, and 89. App. Br. 16-24; *see also* Third Supp. Reply Br. 11-24. Appellants argue the third ground of rejection based on claims 4 through 6, and claims 86 through 88. App. Br. 25-26 and 28-29; *see also* Third Supp. Reply Br. 24-31. Thus, we decide this appeal based on claims 1, 4 through 6, 8, 9, 14, 16, 20, 82, 83, and 86 through 88 as representative of the grounds of rejection and Appellants' groupings of claims. 37 C.F.R. § 41.37(c)(1)(vii) (2005).

### Issues

The issues in this appeal are:

whether Appellants have shown that the Examiner erred in objecting to and rejecting claim 83 under §§ 132 and 112, first paragraph, written description requirement;

whether Appellants have shown that that the evidence in Kindler does not support the Examiner's conclusions of prima facie anticipation with respect to the claimed fuel cell systems and methods of operating a fuel cell stack encompassed by claims 1, 8, 14, 20, and 82;

whether Appellants have shown that that the evidence in Kindler does not support the Examiner's conclusions of prima facie obviousness with respect to the claimed fuel cell systems encompassed by claims 4 through 6 and 86 through 88; and

whether Appellants have shown that that the evidence in the teachings of Kindler in view of Singh and in view of Pun does not support the Examiner's conclusions of prima facie obviousness with respect to the claimed fuel cell systems and methods of operating a fuel cell stack encompassed by claims 9 and 16, respectively.

### Claim Interpretation

In considering the issues raised in this appeal, we interpreted the claims as addressed below by giving the terms thereof the broadest reasonable interpretation in their ordinary usage in context as they would be understood by one of ordinary skill in the art in light of the written

description in the Specification unless another meaning is intended by Appellants as established therein, and without reading into the claim any disclosed limitation or particular embodiment. *See, e.g., In re Icon Health and Fitness, Inc.*, 496 F.3d 1374, 1379 (Fed. Cir. 2007); *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004), and cases cited therein; *In re Morris*, 127 F.3d 1048, 1054-55 (Fed. Cir. 1997); *In re Donaldson Co.*, 16 F.3d 1189, 1192-95 (Fed. Cir. 1994) (*en banc*).

Claim 83: §§ 132 and 112, First Paragraph,  
Written Description Requirement

Addressing first the objection to claim 83 under § 132, we find the Examiner applied the provision specifying “[n]o amendment shall introduce new matter into the disclosure of the invention” to the language of claim 83, “fuel supply apparatus directs a plurality of droplets into the fuel passage in a direction that is substantially parallel to the anode surface,” as amended in the Amendment filed January 11, 2005. Third Supp. Ans. 3. Claim 83 was added in the amendment of February 17, 2004.

The disclosure of the invention is set forth in the Application as filed, that is, in the Specification and claims as filed. *See, e.g.*, 35 U.S.C. § 112, first and second paragraphs; *In re Wertheim*, 541 F.2d 257, 262 (CCPA 1976) (an original claim as filed is its own written description). The proper course where the issue is whether a newly presented or amended claim encompasses an invention supported by the written description of the invention in the application as filed is to consider whether the claim complies with the requirements of § 112, first paragraph, written description requirement. *See* Manual of Patent Examining Procedure § 706.03(o), New

Matter (8th ed., Rev. 6, Sept. 2007). Thus, an objection for new matter under 35 U.S.C. § 132 is inapplicable to claim 83.

In any event, the issues raised by the Examiner and addressed by Appellants in the objection and rejection are in fact the same. Thus, we consider whether appealed claim 83 encompasses subject matter not described in the Application as filed on the basis of the ground of rejection under § 112, first paragraph, written description requirement.

The Examiner must establish a *prima facie* case that claim 83 does not comply with 35 U.S.C. § 112, first paragraph, written description requirement, by setting forth evidence or reasons why, as a matter of fact, the written description in the Specification, claims, and drawings as filed as a whole would not reasonably convey to persons skilled in this art that Appellants were in possession of the invention defined by the appealed claims, including all of the limitations thereof, at the time the Application was filed. *See, e.g., In re Alton*, 76 F.3d 1168, 1172, 1175-76 (Fed. Cir. 1996) (citing *Wertheim*, 541 F.2d at 262-64). The written description in the original disclosure as a whole does not have to describe the invention later claimed *in haec verba*, but such written description “must . . . convey with reasonable clarity to those skilled in the art that . . . [appellant] was in possession of the invention . . . now claimed.” *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563-64 (Fed. Cir. 1991); *see also, e.g., Lockwood v. American Airlines, Inc.*, 107 F.3d 1565, 1571-72 (Fed. Cir. 1997) (the disclosed invention can be described using “such descriptive means as words, structures, figures, diagrams, formulas, etc., that fully set forth the claimed invention”); *Wertheim*, 541 F.2d at 262 (“The function of the



description requirement is to ensure that the inventor had possession, as of the filing date of the application relied on, of the specific subject matter later claimed by him; how the specification accomplishes this is not material.” (citations omitted)). Compliance with § 112, first paragraph, written description requirement, is a question of fact and is determined on a case-by-case basis. *Vas-Cath*, 935 F.2d at 1563.

The Examiner contends the language of claim 83, “fuel supply apparatus directs a plurality of droplets into the fuel passage in a direction that is substantially parallel to the anode surface,” is not supported by the Specification Figures. Third Supp. Ans. 13. The Examiner argues the “arrows” in Specification Figure 1 show the general direction of the fuel droplets toward the fuel passage between anodes, and the “black dot” fuel droplets in Specification Figures 4, 7-9, 13, 16, 18, and 19 illustrate that the width of the band of fuel droplets supplied in the fuel passages “vary irregularly and randomly” along the fuel passage. Third Supp. Ans. 13-16. Thus, the Examiner concludes one skilled in the art “would not recognize that droplets filed [sic] straight out of the drop ejector . . . would travel in a direction that is substantially parallel to the surface of the anode” as claimed. Third Supp. Ans. 15-16.

We are of the opinion Appellants have established the Examiner erred in rejecting claim 83 under § 112, first paragraph, written description requirement. We agree with Appellants’ argument that the language of claim 83, dependent on claim 82, requires only that the fuel supply apparatus “directs” fuel droplets “into” the fuel passage “in a direction” substantially parallel to the anode surface, and not that the fuel droplets must maintain

that direction over the course of the fuel passage as the Examiner contends. App. Br. 11-13; Third Supp. Reply Br. 5-10. In this respect, we further agree with Appellants that Specification Figures 1, 4, 7-9, 13, 16, 18, and 19, as described in the Specification, support this claim language even though the language does not appear in the Specification. App. Br. 11-13; Third Supp. Reply Br. 6 and 8-10. Indeed, we find these Specification Figures illustrate fuel supply apparatus 118, 118a-f directing fuel droplets into fuel passage 114 in a direction substantially parallel to the adjacent anode surfaces as specified in claim 83. *See Spec.*, e.g., 4-11.

Accordingly, the evidence in the Specification and original claims does not support the Examiner's conclusion of *prima facie* non-compliance of claim 83 with 35 U.S.C. § 112, first paragraph, written description requirement.

Thus, we reverse the ground of rejection of claim 83 under 35 U.S.C. § 112, first paragraph, written description requirement.

#### Rejections Based on Prior Art

##### Findings of Fact

We find Kindler would have described to one of ordinary skill in this art fuel cell systems operated by methods which supply an aerosol of liquid fuel droplets suspended in gas to the anodes of a fuel cell stack. Kindler, e.g., col. 1, l. 64 to col. 2, l. 3.

The aerosol of fuel droplets can be generated by such methods as atomization using, for example, "orifices, single fluid nozzles, two fluid nozzles, rotary atomizers, and ultrasonic atomizers." Kindler, e.g., col. 2,

ll. 3-9, 17-19, and 28-33, and col. 7, ll. 14-30. Kindler discloses that in addition to methods of boiling and then rapidly cooling to nucleate condensed droplets of liquid fuel suspended in gas, “[a] wide variety of atomization means are known to those skilled in the art and may be employed in this invention.” Kindler col. 7, ll. 14-22. The latter can include a variety of fluid atomization nozzles, rotating discs, and ultrasonic nozzles. Kindler col. 7, ll. 22-30, and col. 16, ll. 2-10.

Kindler discloses that the amount of aerosol fuel delivered to the anode depends on, among other things, the oxidization catalyst used in the anode, membrane characteristics, fuel concentration, and cell temperature and pressure. Kindler col. 7, ll. 31-39. Kindler discloses:

By monitoring fuel cell operating characteristics . . . it is possible to determine an optimum aerosol feed rate for a given fuel cell configuration and . . . operating conditions. For example, monitoring fuel cell power output, cell potential, or operating current provide convenient measures of fuel cell operating performance suitable for use in controlling the rate of aerosol fuel delivery to the anode.

Kindler, col. 7, ll. 39-46. Kindler discloses several strategies for manipulating the amount of fuel delivered to the anode. Kindler col. 7, l. 47 to col. 9, l. 10. In this respect, “[i]n order to preserve the benefits of an aerosol fuel delivery method, it is preferable to prevent the anode, anode catalyst pores and any anode support or backing materials, from becoming saturated with liquid fuel.” Kindler col. 8, ll. 19-22. Kindler discloses the anode structure is porous and the fuel should wet all of the pores. Kindler illustrates low and high power density operations where the rate of the electrochemical reaction is governed by the rate of diffusion of fuel droplets 432, 532 into an individual pore 434, 534 of porous anode backing material

436, 536 to the catalyst layer 438, 538 in Figures 4 and 5, respectively.

Kindler, e.g., col. 11, ll. 54-65, and col. 13, l. 46 to col. 14, l. 29.

Kindler describes an embodiment in which the aerosol generator is within the anode chamber of the fuel cell and “comprises a plurality of atomizers situated at the inner surface of a flow field element, fed with liquid fuel via a conduit, and acting to uniformly distribute liquid fuel droplets over the surface of the fuel cell anode.” Kindler, e.g., col. 2, ll. 10-19. Kindler illustrates such a fuel cell embodiment in Figure 1 that includes

[a] flow means, which may be a pressurized tank (not shown) or a pump 20 as shown, is provided for circulating an organic liquid fuel . . . to an aerosol generator 21 housed within the anode chamber 22 of housing 12. The aerosol generator comprises a plurality of atomizers 25, which form an aerosol 27 of liquid fuel droplets suspended in a gas that is passed over anode 14.

Kindler col. 5, ll. 27-43, and col. 7, ll. 8-11. Kindler describes another embodiment as illustrated in Figure 3, wherein aerosol generator 321 is outside of the anode chamber 322. Kindler, e.g., col. 2, ll. 20-42, col. 7, ll. 11-14, and col. 9, ll. 17-25.

Kindler illustrates a further embodiment in Figure 6 in which the aerosol generator is within the anode chamber of a fuel cell stack of fuel cell 600. Kindler, col. 15, ll. 57-59. In fuel cell 600, the membrane electrode assembly 608 is formed with, among other things, anode assembly 602 and interposed membrane 604, wherein the anode side of the fuel cell includes anode biplate 602. Kindler col. 15, ll. 59-63; *see also* col. 14, ll. 56-66. “Each anode biplate 602 has an internal surface comprising a flowfield element 610 and an aerosol generator.” Kindler col. 15, ll. 63-65. “Fig. 6 illustrates a preferred aerosol generator comprising a plurality of individual

in situ atomizers, each atomizer 612 situated at the internal surface of the anode biplate 602 so as to atomize liquid fuel droplets into the anode chamber 616,” wherein “[e]ach in situ atomizer 612 may be selected from a wide variety of atomization means.” Kindler col. 15, l. 66 to col. 16, l. 10.

Kindler discloses:

Fig. 6 illustrates an aerosol generator made up of a plurality of nozzles. Each nozzle is an atomizer 612 and is situated at an intersection of at least two flow channels on an inner surface of the flow field element. The intersecting flow channels create islands 614[.] The outlet of each nozzle faces the anode side of the membrane electrode assembly 608. The aerosol fuel for each nozzle is preferably supplied directly against the surface of the membrane electrode at an island 614 formed by the intersecting flow channels. . . .

The inner surface of the flow field element is preferably a hydrophobic surface not wetted by the liquid fuel. A hydrophobic treatment of the flow field element surface, particularly when combined with the use of a hydrophilic catalyst backing layer, promotes wicking of coalesced liquid fuel into the pores of the backing layer where it can be drawn into the reaction zone at the catalyst surface. . . .

Kindler col. 16, ll. 11-18; *see also* col. 15, ll. 24-28.

We find Pun would have evinced to one of ordinary skill in this art that it was known in the art that “all atomizing rotating members regardless of shape generate droplets traveling perpendicularly to the rotating member and generally not in the direction the droplets [sic, are] to be projected,” thus requiring “fans and blowers . . . to project the atomized droplets to intended targets.” Col. 1, ll. 17-24.

A discussion of Singh is not necessary to our decision.

Discussion

Claims 1, 8, 14, 20, and 82: § 102(b)

We reconsidered the record as a whole in light of Appellants' arguments with respect to the grounds of rejection of claims 1, 8, 14, 20, and 82 over Kindler under § 102(b).

The Examiner must establish a *prima facie* case of anticipation under § 102(b) by showing, as a matter of fact, that a single reference describes to one skilled in this art each and every limitation of the claimed invention encompassed by the claim arranged as required therein, either explicitly or inherently. *See, e.g., In re Schreiber*, 128 F.3d 1473, 1477 (Fed. Cir. 1997), and cases cited therein; *In re Bond*, 910 F.2d 831, 832-33 (Fed. Cir. 1990), and cases cited therein; *see also, e.g., Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 772 (Fed. Cir. 1983) (anticipation is established when the claim reads on something disclosed in the reference which meets all of the limitations of the claim).

Claim 1

The plain language of claim 1 specifies a fuel cell system comprising at least a fuel cell stack having a plurality of electrodes in any arrangement and any single fuel supply apparatus that can supply in any manner a plurality of fuel droplets to each of the anodes. Thus, claim 1 requires only that the single supply apparatus must be capable of supplying the fuel droplets without specifying any apparatus components to achieve this result. The language thus encompasses Appellants' fuel supply apparatus embodiments 118c, 118d, and 118e, each having a plurality of drop ejectors, that is, atomizers, 128, 152, 172, which receive fuel from fuel supply line

144 connected to support structure 250, 154, 174 that include a manifold “not shown.” Spec., e.g., 8-9 and Figs. 8, 9, and 13.

On this record, we disagree with Appellants that that the evidence in Kindler does not support the Examiner’s conclusions of prima facie anticipation with respect to the claimed fuel cell systems encompassed by claim 1. Indeed, we agree with the Examiner’s finding that Kindler describes an embodiment in Figure 6 which, taken with the disclosure of Figure 1, meets the limitations of claim 1, as we interpret the language of this claim. Third Supp. Ans., e.g., 4-5 and 16-18. Contrary to Appellants’ contentions, we find one of ordinary skill in this art would determine from Kindler’s disclosure as a whole that the individual atomizers 612 are part of the same aerosol generator fuel supply apparatus that would necessarily include fuel conduits to the atomizers operating inside anode chamber 616 along with other supporting structure in this respect. App. Br. 16-18; Third Supp. Reply Br. 11-15. Indeed, in considering Kindler’s disclosure with respect to Figure 6, one of ordinary skill in this art would be mindful of Kindler’s disclosures that an “aerosol generator comprises a plurality of atomizers situated at the inner surface of a flow field element, fed with fuel via a conduit, and acting to uniformly distribute liquid fuel droplets over the surface of the fuel cell anode;” and that Figure 1 shows a single fuel supply apparatus that is an aerosol generator having a plurality of atomizers 25. *See above* pp. 10-12, citing Kindler col. 2, ll. 10-19, and Figs. 1 and 6. Thus, we are of the opinion the Examiner has not impermissibly mixed and matched elements of the aerosol generators illustrated in Kindler’s Figures 1 and 6 as Appellants contend. Third Supp. Reply Br. 14.

Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of anticipation found in Kindler with Appellants' countervailing evidence of and argument for non-anticipation and conclude, by a preponderance of the evidence and weight of argument, that the claimed invention encompassed by appealed claims 1 through 3 and 7 would have been anticipated as a matter of fact under 35 U.S.C. § 102(b).

#### Claims 8, 14, and 82

We agree with Appellants that the evidence in Kindler does not support the Examiner's conclusions of *prima facie* anticipation with respect to the claimed fuel cell systems and methods of operating a fuel cell stack encompassed by claims 8, 14, and 82. The plain language of claim 8<sup>3</sup> specifies a fuel cell system comprising at least, among other things, a fuel cell stack in which the anodes of an anode pair face one another, defining a fuel passage way extending between the surfaces of the anodes in the pair. The plain language of claim 14 similarly specifies a method of operating a fuel cell stack comprising at least directing a spray of fuel droplets into a passage way extending from the surface of a first anode to the surface of a second anode in an anode pair, such that fuel droplets come to rest on both

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<sup>3</sup> In considering the subject matter encompassed by each of claims 8, 9, and 20 as a whole, we have considered the means-plus-function limitations therein in light of the arguments advanced by the Examiner and by Appellants in response to the Remand in Appeal 2006-2320 entered in this Application on October 27, 2006. Third Supp. Ans., e.g., 6-7, 10, and 12-13; Third Supp. Reply Br., e.g., 2-4; *see also* App. Br. 3-4 and 6. Appellants do not contend that the disclosure of Kindler alone and as



anodes. The plain language of claim 82 also specifies a fuel cell system comprising at least a fuel cell including a fuel passage adjacent to the surface of at least one anode and a fuel supply that directs fuel droplets into the fuel passage in a direction non-perpendicular to the anode surface that receives fuel. We agree with Appellants that the embodiments encompassed by claims 8, 14, and 82 can include those depicted in Specification Figures 1 and/or 3. App. Br. 3-4, 5, and 6. However, there is no basis in the claim language or in the Specification to read these embodiments into the claims as limitations. *See, e.g., In re Zletz*, 893 F.2d 319, 321-22 (Fed. Cir. 1989).

The Examiner relies on the fuel droplet containing anode pores illustrated in Kindler's Figures 4 and 5, contending that fuel in a fuel passage way between the surfaces of two anodes is thus described. Third Supp. Ans., e.g., 6-7, 9, 19-20, 21, and 22-23. Appellants contend Kindler's Figures 4 and 5 illustrate a pore within a single anode. Third Supp. Reply Br., e.g., 17-19, 20-21, and 23-24.

On this record, we agree with Appellants. As a matter of fact, Kindler's Figures 4 and 5 each illustrate an individual pore of porous anode backing material, and thus, do not describe a fuel passage way that permits fuel droplets to contact the surface of the anode(s) but is separate from the anode(s) as specified in claims 8, 14, and 82 as we interpreted these claims above. *See above* p. 10.

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combined with Singh does not describe fuel supply means specified in claims 8, 9, and 20, and suggest the storage means specified in claim 9.

Accordingly, in the absence of a prima facie case of anticipation, we reverse the grounds of rejection of claims 8, 11 through 15, 17, 82, 84, 85, and 89 under 35 U.S.C. § 102(b).

#### Claim 20

We also agree with Appellants that the evidence in Kindler does not support the Examiner's conclusions of prima facie anticipation with respect to the claimed fuel cell systems encompassed by claim 20. The plain language of claim 20 specifies a fuel cell system comprising at least, among other things, a controller adapted to monitor the fuel rate consumption at the anode and to control the fuel supply means to supply droplets at a rate that maintains a fuel layer on the anode. The Examiner acknowledges Kindler does not specifically disclose a controller, but takes the position that "such controller is inherent, given that both [Kindler] and the present application utilize similar operation procedure and control sequence to operate the direct oxidation fuel cell system." Third Supp. Ans. 8. The Examiner further contends Kindler "teaches that it is preferable to prevent the anode, anode catalyst pores and any anode support or backing material, from becoming saturated (flooded) with liquid fuel," and "suggests the formation of a discrete layer of fuel . . . upon the determination of the optimum fuel feel [sic, feed] rate by the fuel controller." Third Supp. Ans. 22, citing Kindler col. 8, ll. 19-29; *see above* pp. 9-10. The Examiner argues that a claimed feature missing from a reference is inherently described if the feature is necessarily present in that which the reference describes. Third Supp. Ans. 8, citing *In re Robertson*, 169 F.3d 743 (Fed. Cir. 1999).

Appellants contend the Examiner's arguments do not lead to the conclusion that the teachings of Kindler necessarily describes a fuel cell system having a controller which can monitor the rate of fuel consumption at the anode and maintain a fuel layer on the anode as claimed to one skilled in this art within the meaning of § 102(b), and indeed, would appear to suggest that a fuel layer should not be maintained on the anode surface. App. Br. 21-22; Third Supp. Reply Br. 21-22.

It is well settled that in order to establish that a claim element is inherent in a single prior art reference, it must be established by evidence that such limitation is necessarily present in the description in the reference, and that it would be recognized as such by one of ordinary skill in the art. *Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268 (Fed. Cir. 1991) (silence in a reference about an inherent characteristic may be explained by extrinsic evidence which "must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill"); *In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981) ("Inherency . . . may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient."); *see also, e.g., Transclean Corp. v. Bridgewood Serv., Inc.*, 290 F.3d 1364, 1372-73 (Fed. Cir. 2002); *MEHL/Biophile Int'l Corp. v. Milgram*, 192 F.3d 1362, 1365 (Fed. Cir. 1999); *Robertson*, 169 F.3d at 745.

We agree with Appellants that the Examiner has not established as a matter of fact that Kindler would have inherently described a controller meeting the limitations of claim 20 to one skilled in this art. While we agree

with the Examiner that this person would find in Kindler the direction to monitor fuel cell operating characteristics to optimize aerosol fuel delivery to the anode and strategies for delivering fuel on that basis, we find as a matter of fact that Kindler does not inherently describe monitoring and maintaining a fuel layer on the surface of the anode. Indeed, Kindler at best discloses that the fuel should “wet” all pores of the anode without saturating the anode assembly including the pores. However, Kindler does not describe how to monitor these conditions, disclosing only monitoring fuel cell power output and other indicators of fuel cell operating performance, and controlling fuel delivery based on these performance measurements. *See above* pp. 9-10.

Accordingly, in the absence of a prima facie case of anticipation, we reverse the grounds of rejection of claim 20 under 35 U.S.C. § 102(b).

Claims 4 through 6, 9, 16, and 86 through 88: § 103(a)

We reconsidered the record as a whole in light of Appellants’ arguments with respect to the grounds of rejection under § 103(a) of claims of claims 4 through 6 and 86 through 88 over Kindler, of claim 9 over Kindler in view of Singh, and of claim 16 over Kindler in view of Pun.

#### Claim 9

We determine Appellants have shown that the evidence in the teachings of Kindler in view of Singh does not support the Examiner’s conclusions of prima facie obviousness with respect to the claimed fuel cell systems encompassed by claim 9, dependent on claim 8. The Examiner relies on the teachings of Kinder we discussed above with respect to claim 8. Third Supp. Ans. 10-11. Appellants contend the teachings of Singh do not

supply the teachings absent in Kindler with respect to claim 8, and thus claim 9 is free of the applied prior art for the same reasons as claim 8. App. Br. 26-27. The Examiner does not dispute Appellants' contention. *See generally* Third Supp. Ans.

Accordingly, in the absence of a prima facie case of obviousness, we reverse the grounds of rejection of claim 9 under 35 U.S.C. § 103(a)

#### Claims 4 through 6 and claims 86 through 88

We determine Appellants have shown that the evidence in Kindler does not support the Examiner's conclusions of prima facie obviousness with respect to the claimed fuel cell systems encompassed by claims 4 through 6 and claims 86 through 88. The plain language of each of independent claims 4 through 6 specifies a fuel cell system comprising at least, among other things, a thermal drop ejector, a piezoelectric drop ejector, and a flexensional drop ejector, respectively. Each of claims 86 through 88, dependent on claim 82, encompass the same drop ejectors, respectively.

There is no dispute that Kindler discloses an ultrasonic atomizer but none of the specified drop ejectors. *See above* p. 9. The Examiner takes the position that Kindler teaches a wide variety of atomizing means, and thus it would have been within the ordinary skill in the art to use the functionally equivalent drop ejectors specified in these claims in place of Kindler's atomizers. Third Supp. Ans. 9-10. In response to Appellants' contention in the Supplemental Reply Brief that there is no evidence in the record showing the alleged equivalency, the Examiner states that he "has come to realize that

the different ejectors in claims 4 through 6 are not widely recognized in the patent literature, let alone in the fuel cell art.” Third Supp. Ans. 24; Supp. Reply Br. 15-16. The Examiner states that the term “flexitensional drop ejector” is identified only in the present Specification in the USPTO EAST data base, and that the terms “thermal drop ejector” and “piezoelectric drop ejector” are found in two patent literature references, respectively, but the Examiner does not identify such references as pertaining to fuel cell systems. Third Supp. Ans. 24. The Examiner finds that a reference is unnecessary to establish equivalency because functional and mechanical equivalency between Kindler’s atomization ejectors and the claimed drop ejectors “is established based on the limited description and technical information available in the instant disclosure.” Third Supp. Ans. 24-25 and 27-29.

Appellants contend Kindler’s teachings of fuel cell systems having “a ‘boiling/cooling’ drop generator” or “a variety of atomizing drop generators” does not suggest that the same could be replaced with the claimed drop ejectors, and the Examiner has not adduced evidence of equivalency or that the claimed drop ejectors were recognized in the fuel cell art. Third Supp. Reply Br. 25-27 and 29-31. Appellants point out “official notice” of the claimed injectors by the Examiner was traversed in the Amendment filed February 12, 2004. Third Supp. Reply Br. 27, n.4. Appellants thus argue the Examiner has not established that the use of the claimed injectors was known in the fuel cell art, in any other fuel consuming device, or in any prior art, and reliance on the disclosure in the Specification in this regard is improper. Third Supp. Reply Br. 28 and 30-31.

The Examiner’s conclusion of prima facie obviousness under

§ 103(a) must not be based on conclusory statements; but on articulated reasoning with some rational underpinnings based on the knowledge in the prior art evinced by scientific and/or patent literature. Such knowledge is not established by information of record only in Appellants' disclosure of the claimed invention in the Specification. *See, e.g., KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007) (“[I]t can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.”); *In re Kahn*, 441 F.3d 977, 987-88 (Fed. Cir. 2006); *In re Rouffet*, 149 F.3d 1350, 1358 (Fed. Cir. 1998) (“hindsight” is inferred when the specific understanding or principal within the knowledge of one of ordinary skill in the art leading to the modification of the prior art in order to arrive at appellant's claimed invention has not been explained); *In re Fritch*, 972 F.2d 1260, 1266 (Fed. Cir. 1992) (“The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the

modification.”); *In re Dow Chem. Co.*, 837 F.2d 469, 473 (Fed. Cir. 1988);<sup>4</sup> *In re Warner*, 379 F.2d 1011, 1016 (CCPA 1967).<sup>5</sup>

Indeed, the evidence of the knowledge in the art must teach or suggest the function performed by the methods would achieve the same or similar results in order to establish that one of ordinary skill in the art would have been motivated to substitute one method for another in modifying the apparatus or process of a reference. *See, e.g., KSR*, 127 S. Ct. at 1739 (a patent claiming a combination of elements known in the prior art is obvious if the improvement is no more than the predictable use of the prior art elements according to their established functions); *In re Siebentritt*, 372 F.2d 566, 567-68 (CCPA 1967) (express suggestion to interchange methods which achieve the same or similar results is not necessary to establish obviousness).

The USPTO “may take notice of facts beyond the record which, while

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<sup>4</sup> The consistent criterion for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that [the claimed process] should be carried out and would have a reasonable likelihood of success, viewed in light of the prior art. Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant’s disclosure. [Citations omitted.]

*Dow Chem.*, 837 F.2d at 473.

<sup>5</sup> Thus, where the invention sought to be patented resides in a combination of old elements, the proper inquiry is whether bringing them together was obvious and not, whether one of ordinary skill, having the invention before him, would find it obvious through hindsight to construct the invention from elements of the prior art.

*Warner*, 379 F.2d at 1016.



not generally notorious, are capable of such instant and unquestionable demonstration as to defy dispute,” but

[a]ssertions of technical facts in areas of esoteric technology must always be supported by citation to some reference work recognized as standard in the pertinent art and the appellant given . . . the opportunity to challenge the correctness of the assertion or the notoriety or repute of the cited reference.

*In re Ahlert*, 424 F.2d 1088, 1091-92 (CCPA 1970) (citations omitted).

Here, as Appellants point out, the Examiner has not established that the drop ejectors specified in claims 4 through 6 and 86 through 88 are well known to the extent that one of ordinary skill in the fuel cell art would have been so familiar therewith, either through their use in the fuel cell art or in an analogous application in another art, that, unquestionably, knowledge thereof was within the ordinary skill in the fuel cell art. Indeed, the Examiner has acknowledged that these drop ejectors were not widely known. Furthermore, the Examiner improperly relies on Appellants disclosed invention in these respects. Thu, in the absence of evidence disclosing a thermal drop ejector, a piezoelectric drop ejector, and a flextensional drop ejector, and their characteristics, the Examiner’s position is neither supported nor explained, leading to an inference of hindsight.

Accordingly, in the absence of a prima facie case of obviousness, we reverse the grounds of rejection of claims 4 through 6, and 86 through 88 under 35 U.S.C. § 103(a).

#### Claim 16

We determine Appellants have not shown that the evidence in the teachings of Kindler in view of Pun does not support the Examiner’s

conclusions of prima facie obviousness with respect to the claimed methods of operating a fuel cell stack encompassed by claim 16. The plain language of claim 16 specifies a method comprising at least the steps of, among other things, directing a spray of fuel droplets towards and onto the surface of anode with a fan. The Examiner contends that one of ordinary skill in this art would have modified Kindler's fuel cell system by employing the fan acknowledged by Pun to project fuel droplets towards and onto the surface of an anode as claimed. Third Supp. Ans. 11-12 and 26-27. Appellants contend Pun is directed to a particular spray apparatus that produces a particular result with respect to agricultural applications, and thus would not have motivated one of ordinary skill in the art to modify Kindler's fuel cell system. Third Supp. Reply Br. 32. Appellants argue that the Examiner has not identified a common problem that one of ordinary skill in this art would associate with a fuel cells and an agricultural apparatus, and thus Pun is not analogous prior art. Third Supp. Reply Br. 32-33.

We disagree with Appellants' position. The Examiner relies on the knowledge in the prior art with respect to the use of fans with atomizing rotating members evinced by Pun and not on the invention disclosed by Pun. *See above* p. 12. Kindler discloses that the atomization means for the fuel cell system includes rotating discs. *See above* p. 9. Thus, one of ordinary skill in this art armed with the knowledge in the art as evinced by Pun and routinely following the teachings of Kindler would have recognized that a fan can improve the performance of Kindler's atomizing rotating discs and would have been motivated to modify Kindler's fuel cell system accordingly. *See, e.g., KSR*, 127 S. Ct. at 1739 (a patent claiming a

combination of elements known in the prior art is obvious if the improvement is no more than the predictable use of the prior art elements according to their established functions).

Thus, we determine Appellants have not shown that the Examiner erred in concluding the combined teachings of Kindler and Pun would have disclosed the claimed fuel cell system encompassed by claim 16 to one of ordinary skill in the art.

Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of obviousness found in the teachings of Kindler in view of Pun with Appellants' countervailing evidence of and argument for nonobviousness and conclude, by a preponderance of the evidence and weight of argument, that the claimed invention encompassed by appealed claim 16 would have been obvious as a matter of law under 35 U.S.C. § 103(a).

In summary, we have affirmed the grounds of rejection of claims 1 through 3 and 7 under 35 U.S.C. § 102(b) over Kindler, and of claim 16 under 35 U.S.C. § 103(a) over the teachings of Kindler in view of Pun, and have reversed all other grounds of rejection.

The Primary Examiner's decision is Affirmed-In-Part.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(v).

**AFFIRMED-IN-PART**

Appeal 2009-0640  
Application 10/061,830

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